

CLAIMS

1. A backlash reduction apparatus comprising:
means for advancing a substrate;
means for stopping advance of the substrate short of a final intended position;
and
means for finally advancing the substrate.

2. The apparatus of claim 1 wherein the means for stopping operates in response to a means for sensing substrate position.

3. The apparatus of claim 1 wherein the means for finally advancing comprises means for incrementally advancing the substrate.

4. The apparatus of claim 3 wherein the means for incrementally advancing comprises a position-controlled servo motor.

5. The apparatus of claim 3 wherein the means for incrementally advancing comprises a stepper motor.

6. The method of claim 5 wherein the means for finally advancing operates the stepper motor in full steps.

7. The method of claim 5 wherein the means for finally advancing operates the stepper motor in fractions of steps.

8. The method of claim 5 wherein the means for finally advancing operates the stepper motor in microsteps.

9. A backlash reduction apparatus comprising:

- a drive motor that can rotate in increments;
- a drive train driven by the drive motor;
- at least one substrate transport mechanism connected to the drive train and driven by the drive motor therethrough;
- a controller comprising:
 - a substrate advancer in communication with the drive motor, the substrate advancer emitting control signals to the drive motor that cause the substrate to move to a point short of an intended destination; and
 - a substrate final advancer in communication with the drive motor, the substrate final advancer sending control signals to the drive motor that cause the substrate to continue to the intended destination.

10. The apparatus of claim 9 wherein the drive motor is a position-controlled servo motor.

11. The apparatus of claim 9 wherein the drive motor is a stepper motor.

12. The apparatus of claim 9 wherein the signals from substrate advancer cause the drive motor to stop the substrate a predetermined number of increments from the intended destination.

13. The apparatus of claim 12 wherein the predetermined number of increments is greater than a number of increments representing a total possible backlash error in the drive train.

14. The apparatus of claim 12 wherein the substrate final advancer signals cause the drive motor to advance by the predetermined number of increments.

15. The apparatus of claim 9 wherein the substrate final advancer stops the drive motor when a position sensor detects that the substrate has arrived at the intended destination.

16. A backlash reduction method comprising:
advancing a substrate to a point short of a final intended position;
finally advancing the substrate to the final intended position, thereby taking up
backlash in a substrate transport system.

17. The method of claim 16 further comprising monitoring substrate position and sending substrate position information to a controller that initiates the advancing and final advancing of the substrate.

18. The method of claim 16 wherein finally advancing includes advancing the substrate at a lower speed than the speed at which the substrate was advanced to the point short of the final intended destination.

19. The method of claim 16 wherein finally advancing includes advancing the substrate incrementally from the point short of the final intended destination to the final intended destination.

20. The method of claim 16 further comprising providing a drive motor, providing a substrate transport driven by the drive motor, and advancing and finally advancing the substrate is achieved by operation of the drive motor and substrate transport.

21. The method of claim 20 wherein providing a drive motor comprises providing a stepper motor and finally advancing the substrate includes operating the stepper motor in full steps.

22. The method of claim 21 wherein finally advancing the substrate includes operating the stepper motor in fractions of steps.

23. The method of claim 21 wherein finally advancing the substrate includes operating the stepper motor in microsteps.

24. A backlash reduction apparatus comprising:

a drive motor operable in increments;

a drive train driven by the drive motor;

at least one substrate transport mechanism connected to the drive train and driven by the drive motor therethrough;

a controller comprising:

 a substrate advancer in communication with the drive motor, the substrate advancer emitting control signals to the drive motor that cause the substrate to move to a point short of an intended destination; and

 a substrate final advancer in communication with the drive motor, the substrate final advancer sending control signals to the drive motor that cause the substrate to continue to the intended destination; and

the backlash reduction apparatus executing a method comprising:

advancing a substrate to a point short of a final intended position; and

finally advancing the substrate to the final intended position, thereby taking up backlash in a substrate transport system.